

THE MILLIPED GENUS *BOLLMANELLA*
(DIPLOPODA, CHORDEUMIDA, CONOTYLIDAE)

BY WILLIAM A. SHEAR¹

Department of Zoology, University of Florida,
Gainesville, Fla. 32611

Even while my recent (1970) revision of the milliped Family Conotylidae was in press, new data on the family had begun to accumulate. This paper is the first of a series of supplemental reports designed to update our knowledge of the conotylids, a group of millipeds of considerable importance in biogeography.

Like many other milliped genera and species, the genus *Bollmanella*, and its single species *B. oregona*, have remained enigmatic since they were described from a single male specimen by R. V. Chamberlin in 1941. The description of the genus alluded mostly to body form and color, and even contradicted the specific diagnosis of the only included species. The description of *B. oregona* also contained errors, and no illustrations were provided. As if this were not enough, the type locality suggested an error of several hundred miles.

The type of *B. oregona* was in the Chamberlin collection in Salt Lake City. The diplopod portion of the collection has remained uncurated since Chamberlin's death and is in a confused state, but while my conotylid revision was in press, Mr. Thomas Lorenz, then in charge of the collection, found the holotype of *B. oregona* and loaned it to me.

In 1973, I was fortunate in receiving a large number of Berlese extraction samples from Mrs. Ellen Benedict, Portland State University, Portland, Oregon, and from Dr. David Malcolm, Pacific University, Forest Grove, Oregon. These samples were rich in millipeds of many groups previously known only from a very few specimens, and included literally hundreds of individuals of the related genera *Taiyutyla* and *Bollmanella*. Members of these genera must be among the more common humus animals in the area of coastal Oregon. As I mentioned earlier in reporting on part of these collections (Shear, 1973), northern California and the state of Washington are much in need of the kind of thorough exploration by

¹Part of the work for this paper was done while a Richmond Fellow at Harvard University.

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Berlese extraction which Benedict and Malcolm have carried out in Oregon.

It is now possible to do a number of things about *Bollmanella*, which in 1970 I had to treat as a *nomen dubium*. 1) The genus can be characterized as fully distinct and valid, separate from, but related to, *Taiyutyla* and *Conotyla*, and more distant from *Austrotyla* and *Achmenides*, 2) some clear ideas of the distribution of the genus can be gained, and 3) seven new species can be described.

The distribution of the eight known species of *Bollmanella* ranges from southern coastal Oregon to just above the Columbia River in Mason Co., Washington, with one species reported here from the Wallowa Mountains in extreme northeastern Oregon. The scattered nature of the localities suggests that species of *Bollmanella*, except for *B. oregona*, have small ranges, and we might expect many more to be discovered. In particular, the isolated mountain ranges of eastern Oregon need exploration.

Ecologically, *Bollmanella* species have been collected exclusively from litter and duff derived from deciduous trees. Conifer duff and litter support species of *Taiyutyla*, though members of this latter genus are also found in deciduous duff, often syntopically with *Bollmanella* species. Although *B. oregona* ranges from sea level to around 2000' elevation, most of the other species seem to have been collected from forests or parkland between 900' and 1500' elevation. This contrasts again with some species of *Taiyutyla*, which (unpublished data) are known from quite high elevations. Species of an unrelated chordeumid genus, *Rhiscosomides* (Shear, 1973), are found at low elevations and seem to favor coniferous forests. This ecological data also represents information from many collections which did not contain specimens of *Bollmanella*, thus clearly suggesting which habitats are most favorable.

All type specimens of new species have been deposited in the Museum of Comparative Zoology, Cambridge, Mass.

Superfamily Heterochordeumatoidea Pocock

Family Conotylidae Cook

Genus *Bollmanella* Chamberlin

Bollmanella Chamberlin, 1941, Bull. Univ. Utah Biol. Ser. 6(5): 12. Type species, *B. oregona* Chamberlin, by monotypy and original designation.

Diagnosis: With the characters of the family. Small (ca. 6-7 mm long) conotylid millipeds with typical form, distinct in gonopod morphology. Anterior gonopods simple, usually acuminate, but may

be apically laminate, or may bear a basal mesal branch. Anterior gonopod sternum bandlike and well-sclerotized. Posterior gonopods three-segmented, coxal segment with large, prominent colpocoxites characterized by a basal flagellar branch usually more or less sheathed by a development from the main part of the colpocoxite. Apical two segments typical for family. Posterior gonopod sternum with a T-shaped process between the coxae in most species. Third and fourth legpairs of males enlarged, strongly bowed, but with, at most, small mesal femoral knobs. Legpairs 5-7 either normal in size and form, or decreasing from slightly enlarged to normal in size. Prefemora of male legpair 11 with mesobasal processes. Female genitalia without any useful taxonomic characters.

Remarks: *Bollmanella* is clearly related to *Taiyutyla*, with which it is entirely sympatric, and often syntopic. However, the uniformly smaller size, the flagellar branch of the posterior gonopods, and the T-shaped process of the posterior gonopod sternum clearly set *Bollmanella* species apart as a distinct phyletic line.

I would like to comment further on the Family Conotylidae as a whole, but several factors preclude it at this time. The genus *Taiyutyla* remains to be revised, and is affected by, as are any conclusions about Conotylidae at this time, the description by Loomis and Schmitt (1971) of several extremely interesting new higher taxa related to conotylids, including new subfamilies and a new family. The *Taiyutyla* material I have examined so far will also enable me, in this projected future paper, to comment in detail on the functional aspects of the gonopod complex.

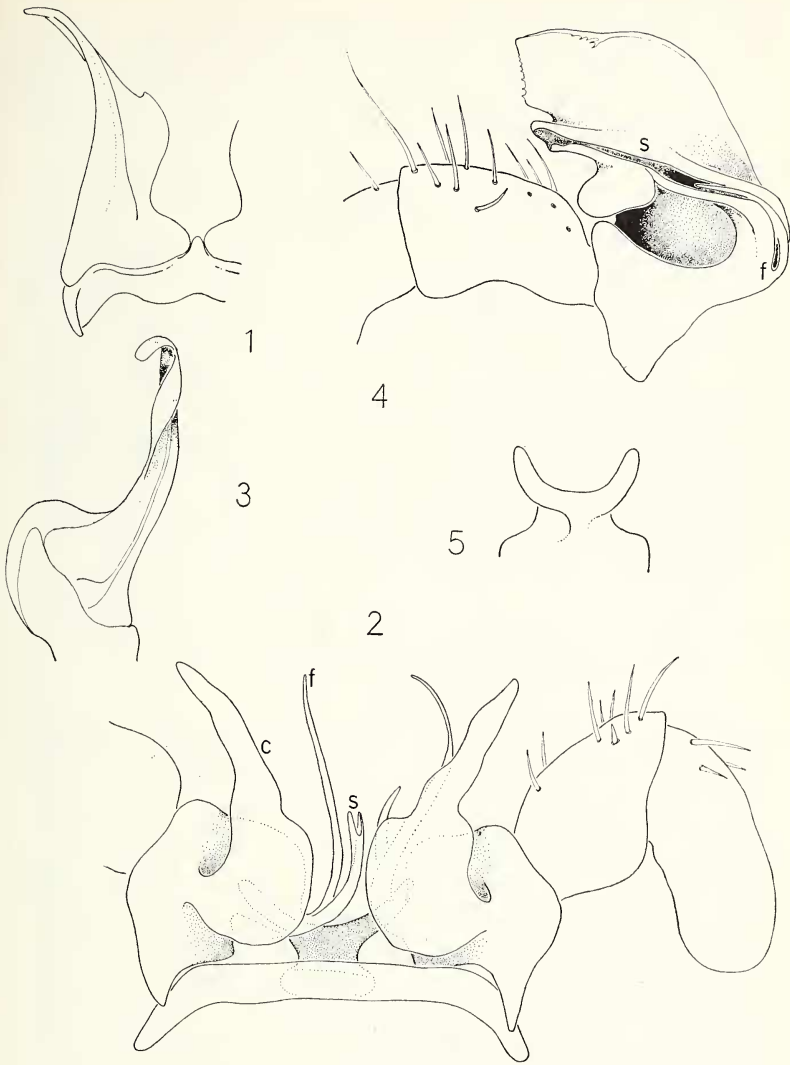
I am still unable to find any taxonomically useful characters that will allow reliable separation of females of the various species of conotylids, and members of *Bollmanella* are no exception. However, in the hope that some usable characters might turn up in the future, I have designated *bona fide* female paratypes where possible. I do not present a key to the eight known species, as they can readily be separated by reference to the illustrations of the gonopods. The gonopods of these species are so small they must be mounted on slides temporarily (in glycerine) to see detail.

Bollmanella oregona Chamberlin

Figs. 1, 2

Bollmanella oregona Chamberlin, 1941, Bull. Univ. Utah Biol. Ser. 6(5): 12, no illustrations.

Type: Male holotype from "John Day Creek," Douglas Co., Oregon, collected by J. C. Chamberlin, 19 November 1939. In



Figs. 1, 2. *Bollmanella oregona*. Fig. 1. Right anterior gonopod, posterior view. Fig. 2. Posterior gonopods, anterior view. Figs. 3, 4. *B. reducta*. Fig. 3. Left anterior gonopod, posterior view. Fig. 4. Right posterior gonopod, posterior view. Fig. 5. Sternal process between posterior gonopods of *B. laminata*.

Chamberlin collection (now at U.S. National Museum?), examined. There is no John Day Creek in Douglas Co., but there is a town named Days Creek, and a stream of that name, a tributary of the South Umpqua River. Probably this is the type locality, and not the John Day River of Oregon's semiarid northeast.

Description: Male from 10 mi east, 6 mi north of Gold Hill, Jackson Co., Oregon: Length, 7.0 mm. Ocelli 14 on each side (a series of males from several localities had ocelli numbers from 14-17). Legpair 3 much enlarged, femora swollen and bowed mesad, without obvious processes. Legpair 4 enlarged, but smaller than legpair 3, femora not strongly curved, bearing small fungiform basal knobs mesally. Legpairs 5-7 only slightly larger than postgonopodal legs, without processes. Anterior gonopods simple, subtriangular, acuminate, curved posteriolaterad (Fig. 1). Posterior gonopod colpocoxites appearing 3-branched (Fig. 2), flagellar branch (*f*) long, prominent; sheathing structure (*s*) reduced, completely separated from anterior process (*c*), which is simple and without branches. Posterior gonopod sternum with a large T-shaped process (*T*). Pigmentation typical.

Females similar to males, slightly larger and more robust.

Distribution: (all collections by E. M. Benedict) OREGON: *Josephine Co.*, 0.3 mi S, 2.5 mi E O'Brien, T40S/R8W/Sec 28, elev. 1400', 18 December 1971, ♂♂ ♀♀. *Coos Co.*, 3 mi N, 2 mi W North Bend, T24S/R13W/Sec 27, sea level, 15 January 1972, ♂. *Douglas Co.*, Island Campground, 0.5 mi S, 1.0 mi E Steamboat on Ore. Rt. 138, T26S/R1E/Sec 5, elev. 1200', Berlese of maple, dogwood dubb, 20 October 1971, ♂♂; Boulder Flat Campground, 3 mi E, 10 mi S Steamboat, T26S/R2E/Sec 13, elev. 1700', Berlese red alder, vine maple duff, 30 October 1971, ♂; 4 mi S, 9 mi E Steamboat on Ore. Rt. 138, T26S/R2E/Sec 23, elev. 1600', Berlese conifer and oak duff, 30 October 1970, ♂♂ ♀♀. *Jackson Co.*, 10 mi NW Central Point on Ore. Rt. 234, T35S/R2W, elev. 1200', 22 January 1973, ♂♂ ♀. Lewis Buckley Farm, 1 mi S Ruch on Ore. Rt. 238, T38S/R3W, elev. 1700', Berlese litter, duff, soil, 13 November 1971, ♂; Upper Applegate Grange, 6 mi S Ruch, T39S/R3W/Sec 15, elev. 1600', Berlese mixed litter, 13 November 1971, ♂♂ ♀♀; Buckley County Park Rest Area, 3.5 mi S Ruch on Upper Applegate Rd., 2 mi off Ore. Rt. 238, T39S/R3W/Sec 15, elev. 1600', Berlese white alder, willow duff, 13 November 1971, ♂♂; French Gulch, For. Ser. Rd. 420, 3 mi N Copper, T40S/R4W/Sec 36, elev. 1900', Berlese Oregon oak duff, 13 November 1971,

♂ ♀; 15 mi SW Ruch on Upper Applegate Rd., T40S/R3W/Sec. 8, elev. 1800', Berlese duff, debris, moss, bark, 13 November 1971, ♂ ♂; 10 mi E, 6 mi N Gold Hill on Ore. Rt. 234, T35S/R1W/Sec 17, elev. 1300', 22 January 1972, ♂ ♂ ♀♀; 6 mi E, 3 mi N Gold Hill, T35S/R2W/Sec 27, elev. 1200', 22 January 1972, ♂ ♂.

Notes: Chamberlin's brief discussion of the leg modifications is confusing. In the generic diagnosis leg 5 is described as being "normal" while in the specific diagnosis, leg 5 is described as "less thickened, (the) fourth joint with a . . . subconical process on mesal side toward proximal end . . ." Thus *B. oregona* is immediately excluded from the very genus it is being described under! Chamberlin saw 14 ocelli on each side, and gave the size as 7-7.5 mm. The male holotype is in poor condition.

Where ecological data is available, the species appears to occur in duff from deciduous trees. Many samples of coniferous duff did not yield *Bollmanella oregona*. The species has been collected at elevations from sea level to 1900', and thus appears to be primarily a coastal or river valley species, since many samples from higher elevations did not contain *B. oregona*. This is the most widespread and common species of *Bollmanella*.

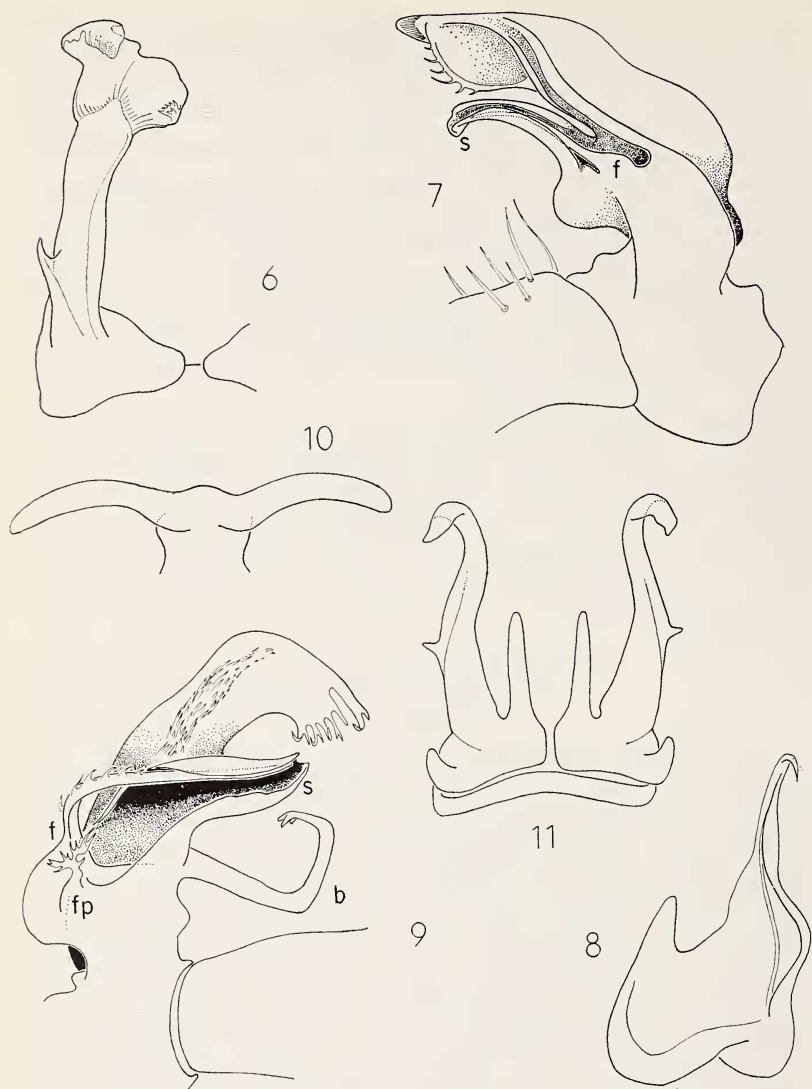
Bollmanella reducta n. sp.

Figs. 3, 4

Type: Male holotype from 2 mi north, 6 mi east of Ashland, Jackson Co., Oregon (T38S/R3E/Sec 27), collected at an elevation of 1200' by E. M. Benedict, 27 December 1971.

Description: Male holotype. Length, 5.0 mm. Ocelli 8 on each side of head. Legpair 3 much as described for *B. oregona*. Legpair 4 less enlarged, lacking basal femoral knobs present in *B. oregona*. Legpairs 5-7 of normal size. Anterior gonopods (Fig. 3) much as in *oregona*, but gonopod tip blunter. Posterior gonopod colpocoxites (Fig. 4) of reduced complexity when compared to following species; flagellum (*f*) short; sheathing structure (*s*) fused anteriorly to body of colpocoxite, which is broad and laminate, with minute teeth distally. T-shaped process of sternum present, but broken in making temporary slide of gonopods. Pigmentation light.

Distribution: Known only from the type locality. The holotype came from a Berlese sample of Oregon oak and buckbrush litter on a steep slope.



Figs. 6, 7. *Bollmanella laminata*. Fig. 6. Right anterior gonopod, posterior view. Fig. 7. Right posterior gonopod, posterior view. Figs. 8-10. *B. unca*. Fig. 8. Left anterior gonopod, posterior view. Fig. 9. Left posterior gonopod, posterior view. Fig. 10. Sternal process between posterior gonopods. Fig. 11. Anterior gonopods of *B. bifurcata*, posterior view.

Bollmanella laminata n. sp.

Figs. 5-7

Types: Male holotype, female paratype and other specimens from 0.3 mi west of Southern Pacific overpass on Rt. 26, 3 mi east of Timber, Washington Co., Oregon (T₃N/R₅W/Sec ?) collected at an elevation of 900' by E. M. Benedict, 27 November 1971.

Description: Male holotype. Length, 6.5 mm. 17 ocelli on each side (a second male had 20 ocelli on each side). Legpair 3 much swollen, femora enlarged and arched mesad, with sharp mesoposterior tooth near each apical end. Legpair 4 normal in size, without processes. Legpairs 5-7 of normal size and form. Anterior gonopods (Fig. 6) erect, bearing lateral tooth near base; apex expanded into thin lamina recurved and folded on lateral edge. Posterior gonopod colpocoxites (Fig. 7) showing relationship to the previous two species, flagellum (*f*) short, sheath (*s*) completely separate from anterior body of colpocoxite, as in *B. oregona*. T-shaped process of sternum with arms sharply curved ventrad (Fig. 5). Pigmentation light, much lighter than *B. oregona* but darker than in *B. reducta*.

Female similar to male in nonsexual characters, somewhat more robust and larger.

Distribution: Known only from the type locality. The types came from a sample of vine maple and Douglas fir duff.

Bollmanella unca n. sp.

Figs. 8-10

Types: Male holotype, juvenile female, and a second male from 4.5 mi east of Wells Creek Ranger Station, Douglas Co., Oregon (T₂₂S/R₉W/Sec 15), elev. 300' collected 11 December 1971 by E. M. Benedict.

Description: Male holotype. Length, 7.0 mm. 14 ocelli on each side of head (second male from type locality had 12 ocelli on each side). Legpair three greatly enlarged, femora strongly bowed mesad, more so than in *oregona*, base of each femur so swollen and curvature so extreme that appearance of large basal knob is presented. Legpair 4 much as in *oregona*, but femoral knob larger, more flattened. Legpairs 5-7 of nearly normal size, lacking knobs. Anterior gonopods (Fig. 8) broadly triangular at base, tapering to curved, sharply aciculate apex, deeply excavated mesoposteriorly at base, with mesal angle drawn ventrad into short, blunt process. Posterior gonopod colpocoxites (Fig. 9) complex; flagellum (*f*) large, long, with mem-

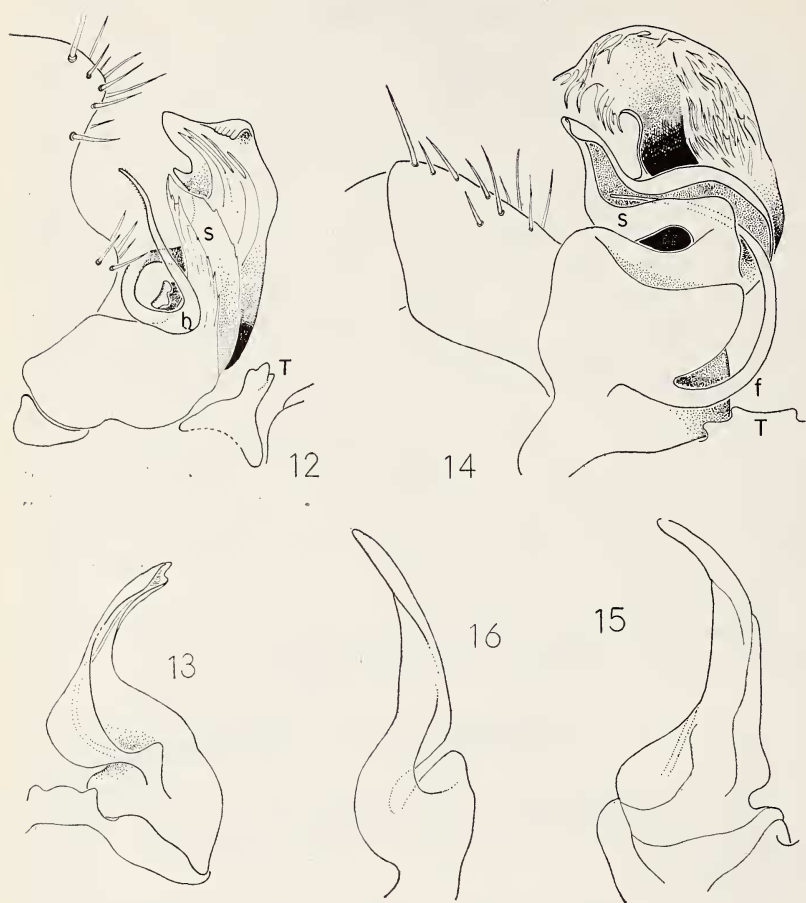


Fig. 12. Right posterior gonopod of *Bollmanella bifurcata*, posterior view. Figs. 13, 14. *B. bella*. Fig. 13. Left anterior gonopod, posterior view. Fig. 14. Right posterior gonopod, posterior view. Figs. 15, 16. *B. camassia*. Fig. 15. Right anterior gonopod, posterior view. Fig. 16. The same, lateral view.

branous serrations on mesal edge; irregular chitinized membrane at base (*fp*); sheath (*s*) large, enfolding flagellum, basally fused to anterior part of colpocoxite. Near point of fusion is large basal process (*b*) which is sharply elbowed and distally trifurcate; colpocoxite with fimbriate ridge mesally and irregular, apical, laminate teeth. T-shaped process from posterior gonopod sternum much the largest in genus, arms extending laterad (Fig. 10). Pigmentation typical, but somewhat darker than in *B. oregona*.

Mature females not collected.

Distribution: In addition to the type locality: OREGON: *Douglas Co.*, Mack Brown County Park on Umpqua R., T25S/R7W, elev. 400', 7 February 1972, E. M. Benedict, ♂.

Notes: Collections at both sites were from Oregon oak duff.

Bollmanella bifurcata n. sp.

Figs. 11, 12

Types: Male holotype, female paratype and other specimens from 2 mi west of Joseph along Hurricane Creek, Wallowa Co., Oregon, collected 23 November 1968 by D. R. Malcolm.

Description: Holotype male. Length, 9.2 mm. 20 ocelli on left side of head, 21 on right side. Legpairs 3 and 4 enlarged, approximately same size, both with small mesal femoral knobs. Legpairs 5-7 decreasing in size, legpair 7 normal in size and form. Anterior gonopods (Fig. 11) upright, curved, with small lateral spine and large blunt mesal branch, presenting bifurcate appearance with telopodite. Posterior gonopod colpocoxites (Fig. 12) rather smaller than usual, flagellum not observed, probably concealed by large sheath (*s*) which is free from coxite for most of its length. Body of coxite with large, spirally curved basal branch (*b*) bearing near its base a curved lamina. Sternal process (*T*) much less prominent than in other species. Pigmentation very light.

Females as usual, similar in general appearance to males, but slightly larger and more robust.

Distribution: Known only from the type locality.

Note: This species is far removed from the other members of the genus, being found in the foothills of the Wallowa Mountains in extreme northeastern Oregon. This part of the state has not been much explored by biologists, and other species of *Bollmanella* may well occur in other isolated mountain ranges. The region is also close to that studied by Loomis and Schmitt (1971), and in which they

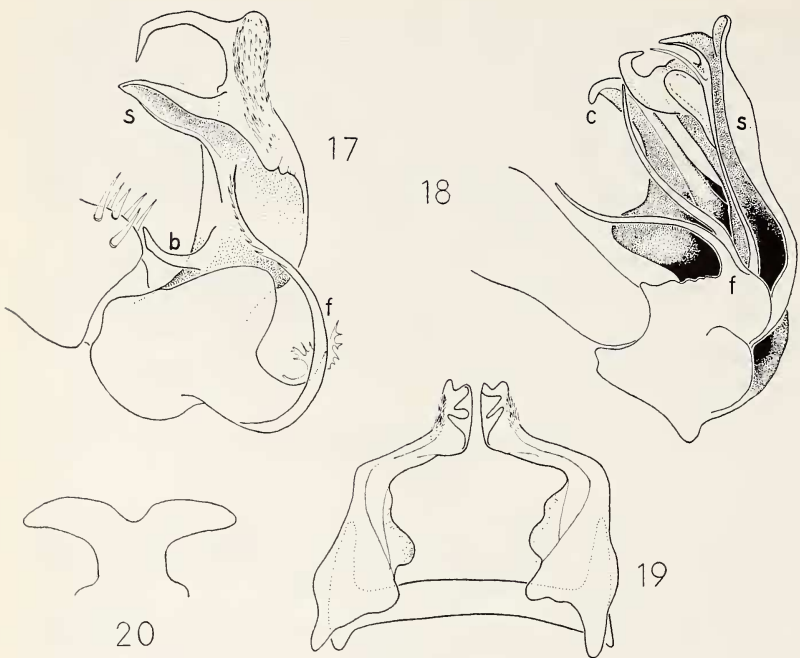


Fig. 17. Right posterior gonopod of *Bollmanella comassia*, posterior view. Figs. 18-20. *B. complicata*. Fig. 18. Right posterior gonopod, posterior view. Fig. 19. Anterior gonopods, posterior view. Fig. 20. Sternal process between posterior gonopods.

found several highly unusual chordeumid species. *Bollmanella bifurcata* shows some intermediacy in size, pregonopodal leg modifications, and gonopod form between species of *Bollmanella* and *Taiyutyla*, and this may suggest that the two genera could be difficult to keep separate in eastern Oregon. Loomis and Schmitt (1971) described *Taiyutyla curvata*, from Montana, but it does not appear (from their illustrations) to be very much like *B. bifurcata*.

The types and several other specimens of both sexes were taken from cottonwood litter, in a riparian situation.

***Bollmanella bella* n. sp.**

Figs. 13, 14

Types: Male holotype and a juvenile female (not designated as a

paratype) from 11 mi east and 4 mi west of Allegany, Company Road 5000 on the Weyerhauser Millicoma Tree Farm (T24S/R9W/Sec 18), at the Douglas and Coos Cos. boundary, Oregon, 20 November 1971, by E. M. Benedict.

Description: Male holotype. Length, 6.0 mm. Ocelli 17 on both sides of head. Femora of legpair three very much enlarged and bearing small knobs mesally just above inflection point of curve. Legpair 4 somewhat smaller, femora with large capitate knobs just distad of midpoint on mesal side. Legpairs 5-7 only slightly larger than normal. Anterior gonopods (Fig. 13) much as usual, curved laterad, acuminate. Posterior gonopod colpocoxites (Fig. 14) somewhat larger than in other species, flagellum (*f*), long, curved into sigmoid sheath (*s*); body of coxite with mesal fimbriate ridge, apically lacinate. Sternal process (*T*) small. Pigmentation dark.

Mature females definitely belonging to this species were not collected.

Distribution: In addition to the type locality, a single female from 6 mi east of Allegany on the Millicoma Tree Farm may also be this species.

Notes: The type was taken in a Berlese sample of myrtle and *Rhododendron* litter and duff; the second female referred to above also came from myrtle litter.

Bollmanella camassia n. sp.

Figs. 15-17

Types: Male holotype and female paratype from 2 mi northeast of Camas Valley on Oregon Rt. 42 (T29S/R8W), collected at an elevation of 1400' by E. M. Benedict, 19 February 1972.

Description: Male holotype. Length, 7.0 mm. Ocelli 12 on both sides of head. Legpair 3 much less enlarged than in other species, with a small knob near distal ends of femora, which are evenly curved and swollen. Legpair 4 only slightly larger than normal, femoral knobs basal in position. Legpairs 5-7 normal in size and form. Anterior gonopods (Figs. 15, 16) simple, acuminate, curved; in lateral view, gland channel (?) originates in deep anteriolateral depression. Posterior gonopod colpocoxites (Fig. 17) with long flagellum (*f*) bearing irregular membranous process near base; sheath (*s*) arising from midpoint of coxite; coxite bears a strong decurved process apically and a small basal branch (*b*). Sternal process not observed, perhaps absent. Pigmentation as in *B. oregona*.

Female as usual, somewhat larger and more robust than male.

Distribution: Known only from the type locality.

Notes: The holotype came from a Berlese sample of vine maple, willow, and Madrone duff near a grove of Douglas firs.

Bollmanella complicata n. sp.

Figs. 18-20

Types: Male holotype and paratype from 1 mi west of Bayshore, 4 mi north of Shelton, Mason Co., Washington, collected 25 November 1967, by E. M. Benedict.

Description: Male holotype. Length, 6.0 mm. 13 ocelli on each side of head. Legpair 3 enlarged as usual, but less curved mesad. Legpair 4 nearly normal in size and form, without femoral knobs. Legpairs 5 and 7 of normal size and form. Anterior gonopods (Fig. 19) sharply elbowed mesad after crossing (*in situ*) laterad of posterior gonopod colpocoxites; apically laminate. Posterior gonopod colpocoxites (Fig. 18) most complex in genus; flagellum (*f*) with two branches about equal in size, one of these may be the homolog of the basal lamina seen in other species; sheath (*s*) free, apically with complex series of hooked, bulbous and aciculate processes; body of coxite (*c*) very broad basally, flared, tapering to hooked apex. Sternal process (Fig. 20) large, arms searly horizontal. Pigmentation light.

Females not collected.

Distribution: Known only from the type locality.

Notes: The holotype and paratype were collected from a Berlese sample of oak and pine duff.

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